# Changes in the Hydrometeorological Regime in the Pacific Southwest

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## Abstract

Selected hydrometeorological (HM) data for the Pacific Northwest and atmospheric and North Pacific sea-surface temperature (SST) data are examined for three successive periods that are subsets of the historical record to estimate if their characteristics have changed. The HM data consist of monthly and water year precipitation totals for 50 sites in western Washington and streamflow averages for 112 sites in Washington, Oregon, and Idaho. The atmospheric information consists of the Southern Oscillation Index (SOI), Pacific North America Index (PNA), measures of the east-west and north-south components of geostrophic flow, and 700-mb height data. The atmospheric and SST data were examined because the HM regime is coupled to atmospheric circulation.

The water year subsets of the record were identified as pre-1947 (pre), 1947-1976 (base), and post-1976 (post). Means were calculated for the water year (October-September), the runoff season (March-August), the winter season (October-February), and a baseflow season (August-September). Differences in means and ratios of the means between the pre/post and the base periods were then examined for changes.

All but two water-year and winter-season means decreased compared to the base period, indicating a spatially consistent and distinct change in the HM regime during winter for the pre/post periods. For the runoff season, precipitation at most sites decreased for the pre period and increased for post period, indicating two different HM regimes during these periods. For both pre/post periods, water-year precipitation decreased because of decreased winter precipitation; however, the post-period water-year values did not decrease as much because of more precipitation in the runoff season. The water-year discharge for 97 of the 112 sites was less than the base period for both pre/post periods. Of the 15 sites with increased discharge, 14 were in a well-defined region and 13 had increases only for the post period. Winter-season streamflow decreased at all but 11 sites. Except for sites with increased annual discharge, means also decreased for the runoff season.

Changes in the SOI and PNA from the base period were generally similar to those of the HM data. Negative values of the SOI for the post period were more persistent than those in the historical record. Changes in the PNA were reflected in both atmospheric flow components. The 700-mb data display trends and differences between the base and post periods that are generally associated with warmer and drier conditions. SSTs have a significant long-term trend, and there have been large changes in monthly values between the base and post periods. These changes in atmospheric and SST data are clearly linked to and have influenced changes in the HM regime. Together, these changes suggest that an HM regime occurred during the post period that had not occurred in the historical record analyzed in this study: a regime with increased runoff-season precipitation over part of the Pacific Northwest and decreased water-year precipitation and streamflow over all but one region.

In: C.M. Isaacs and V.L. Tharp, Editors. 1996. *Proceedings of the Twelfth Annual Pacific Climate (PACLIM) Workshop, May 2-5, 1995.* Interagency Ecological Program, Technical Report 46. California Department of Water Resources.